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A Demonstration of a Computationally Intensive Situation Awareness Methodology

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ARL-TR-2025

August 1999

Army Research Laboratory
Aberdeen Proving Ground, MD 21005-5067

ARL-TR-2025 **August 1999**

A Demonstration of a Computationally Intensive Situation Awareness Methodology

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Abstract

This report describes a demonstration of a situation awareness methodology that is driven by modular semi-automated force (ModSAF), a battlefield simulation used throughout the Department of Defense (DOD). The methodology relies on information distribution technology (IDT) to minimize message traffic over bandwidth-restricted combat net radios. The use of ModSAF will allow IDT applications to be a part of other simulations and help transfer that technology to other systems.

Acknowledgments

The authors would like to thank Sam Chamberlain and George Hartwig for their significant contributions to this project. Sam was the force behind the use of ModSAF to drive the demonstration. George wrote the "Factbase" Input Utility (FIU)* that was used to enter enemy deployment and ammunition usage information into the database.

The authors would also like to acknowledge George Hartwig and A. Brinton Cooper III for their excellent reviews.

*For details on the FIU, contact George Hartwig, (410) 278-8949.

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Executive Summary

This report describes the Computation Based Situation Awareness Methodology Demonstration (CBSAMD). The CBSAMD uses a model-based computationally intensive paradigm to implement situation awareness, as opposed to a more traditional message-based communications intensive paradigm. The advantage of such a paradigm is to conserve radio bandwidth, a very scarce resource on the tactical battlefield. Single Channel Ground and Airborne Radio System (SINCGARS) radios, in particular, are restricted in this regard). For situation awareness (SA) to exist on the modern battlefield, information must be collected, correctly routed, and assimilated. This must occur automatically as to leave the soldier free to fight the battle. In current systems, the tendency is to supply *position* awareness and not *situation* awareness. Joint Surveillance Target Attack Radar System (JSTARS) images, as seen in Desert Storm press releases, show where vehicles are but do not indicate how well the mission is progressing. Only when the analyst combines current positional data for both friendly and enemy forces with the maneuver plan, associates units with the vehicles, and compares their locations to where they are expected to be is true SA obtained.

The CBSAMD was constructed from the modules described next. Each module is a separate application and has one or two primary functions.

- Modular Semi-Automated Forces (ModSAF) is a battlefield simulation that drives the demonstration. It generates position and functionality data for every fighting entity on the battlefield.
- Distributed Interactive Simulation (DIS) Manager is an application program suite that formats data generated by ModSAF so that it can be easily understood by humans.
- Protocol Data Unit (PDU) Filter filters information out of DIS Manager's output that is relevant to the demonstration. It is written in Perl a general-purpose interpreted language. Perl is a language for easily manipulating text, files, and processes. It does many jobs that were formerly done by C programs, shell programs, and text editors such as Stream Editor (SED).
- Berkeley Socket Client Application (BSCA) opens a socket on a server application running on a demonstration node and writes data to it.
- Berkeley Socket Server Application (BSSA) receives data and writes it to the Position/Sensing/Ammunition (P/S/A) Tee.
- P/S/A Tee is a Perl program that splits the data into two streams and pipes one to Route Check and the other to the "Factbase" Input Utility (FIU).
- Route Check accepts the actual position of a unit as input and compares the actual position with its planned location.
- Shape of Certainty (SOC) Monitor is notified by the Distributed "Factbase" (DFB) when the current unit is not where it is expected to be, as defined by its sequential objectives and tolerance.

- FIU enters enemy deployment and ammunition usage information into the DFB.
- DFB contains a database describing the current situation, plans, and reference data: provides interprocess communication between the modules; and sends and receives data to/from other DFBs over combat net radios.
- Display Manager graphically shows sequences and planned locations of all units and actual position of current unit.

The interaction of the various modules is depicted in Figure ES-1, shown on the next page. Distribution of the data is controlled by the DFB. It contains a set of rules that tells it when to communicate with other units (actually their DFBs) and what data to send. Other rules notify applications when certain actions occur (e.g.. a unit's planned movements). By having all the applications store data in the DFB, it is much easier to replace one application with another. The programs need to know how to interface with the DFB, not with each other. A unit will be running several applications connected to its DFB, not just the ones described previously for SA. The SA programs plug into the existing DFB and communication systems.

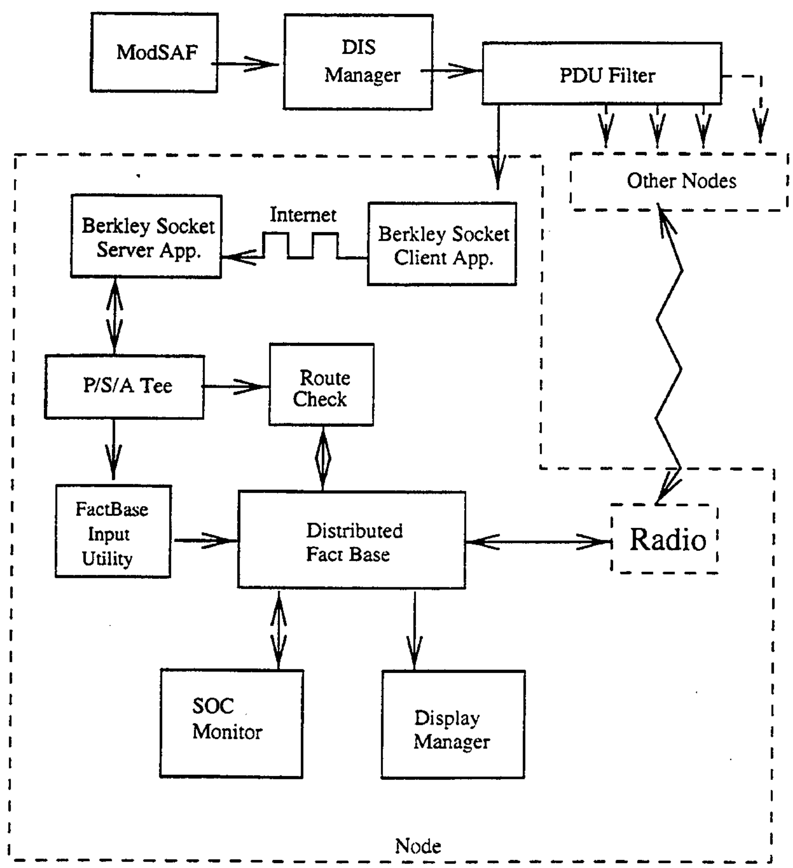

Figure ES-1. Block Diagram of SA Demonstration.

1. Introduction

Information distribution technology (IDT) was a long-term research project of the Communications and Network Division of the Information Science and Technology Directorate (IS&TD) of the U.S. Army Research Laboratory (ARL). IDT combined the power of the modern digital computer with the tenets of model-based battle command (Chamberlain 1990). By devising a way of exchanging tactical information over low-bandwidth channels (i.e., combat net radios), sophisticated command and control tools could be deployed to lower echelons than previously possible. The Computation Based Situation Awareness Methodlogy Demonstration (CBSAMD) described in this report was built by members of the IDT team. It extends the IDT methodology to perform situation awareness by including the deployment of enemy units. Observations of enemy units are entered into the Distributed "Factbase" (DFB) as sensing facts. Another innovative aspect of the CBSAMD is the use of the Modular Semi-Automated Forces (ModSAF) software, a widely used battlefield simulation, as the driver.

The scenario for the CBSAMD is a chance encounter between a single M1A1 tank platoon and two T80 platoons. The M1A1 platoon is accompanied by a single AH-64D (Apache) helicopter, and the T80 platoons are accompanied by a single Mi24 helicopter. The five nodes of the demonstration represent the computer and communication resources of the four M1A1 tanks and the Apache helicopter. At the beginning of the CBSAMD, every node starts its own DFB and other applications. The applications connect to the DFB and extract whatever initial data they need; for example, Route Check gets all sequential objectives. ModSAF is started and the scenario is loaded. The Distributed Interactive Simulation (DIS) Manager server program is started. The ModSAF exercise is started. The DIS Manager client program is started, and the Berkeley Socket Client Application (BSCA) program connects to the Berkeley Socket Server Application (BSSA). Then, at fixed time intervals, the following steps occur.

(1) The Protocol Data Unit (PDU) Filter filters out position data, ammunition usage, and observations of enemy units.

(2) The BSCA pipes the data to the BSSA.

(3) The Position/Sensing/Ammunition (P/S/A) Tee splits the data into two streams. One stream feeds ammunition usage and observations of enemy units into the "Factbase" Input Utility (FIU) and the other feeds position data into Route Check.

(4) The FIU stores ammunition usage and enemy deployment in the DFB.

(5) Route Check computes the planned location of every desired unit and stores the results in the DFB.

(6) Route Check determines if the current position is within the allowable area of the unit's planned location.

(7) Route Check stores the actual position and the result of step (6) in the DFB.

(8) The DFB notifies the Display Manager that certain units have moved so it may update its map.

(9) If the unit is not where it is expected to be, the DFB alerts the Shape of Certainty (SOC) Monitor application. Other DFBs may be notified by radio.

(10) The process repeats.

The modules and steps described previously were designed to provide SA with minimal radio traffic by using preplanned sequential objectives and model-based battle command.

2. Components of the CBSAMD

2.1 ModSAF

ModSAF is a powerful battlefield simulation that has much of the military science built in (i.e., the operator does not have to control the reaction of units to obstacles presented by terrain or enemy units). Furthermore, ModSAF will react to a specific situation in different ways at different times, as might different (or even the same) military commanders. This feature helps to ensure the realism of enemy engagements. This feature also adds the challenge of forcing the IDT software to adapt to unforeseen situations. ModSAF creates and controls entities within a simulated battlefield. Its goal is to replicate the outward behavior of units and their component vehicles and weapons system.

A ModSAF exercise can be conducted by multiple parties at widely separated locations. ModSAF distributes information covering every aspect of a battle over local-area networks (LANs) or the Internet though a comprehensive set of PDUs. PDUs make up a comprehensive set of data structures for organizing and distributing battlefield information. There are 27 different PDUs. The PDUs that contain data relevant to this demonstration are the Entity State, Fire, and Signal PDUs. The Entity State PDUs contain unit location and status data. Fire PDUs contain information concerning the firing of weapons. They are used by the demonstration to track ammunition usage. Signal PDUs carry information concerning sightings of enemy vehicles (Distributed Interactive Simulation 1998).

ModSAF was developed by Lockheed Martin Federal Systems Inc., Advanced Distributed Simulation, for the U.S. Army Program Manager Distributed Interactive Simulation (PM-DIS). It is distributed by the Defense Modeling, Simulation, and Tactical Technology Information Analysis Center (DMSTTIAC) Service Center, Orlando, FL. (Defense Modeling, Simulation, and Tactical Technology Information Analysis Center 1996).

ModSAF drives the CBSAMD by providing the time and the unit's location at fixed time intervals. It also supplies information regarding sightings of enemy vehicles and ammunition usage. With minimal effort, the CBSAMD could be driven by input from actual combat exercises or by other simulators.

2.2 Distributed Interactive Simulation (DIS) Manager

The DIS Manager application suite was written at the U.S. Army Research Laboratory (Smith 1994). It captures the PDUs transmitted over the network by ModSAF. It can output the PDUs in binary or ASCII format. ASCII format was used in the CBSAMD because it was easier to write a program to filter out the data relevant to the demonstration (PDU Filter). Two components of the suite are used by the CBSAMD. A server component intercepts the PDUs, and a client component formats the PDUs and prints them.

2.3 PDU Filter

PDU Filter is a program written in the Perl language. Perl is a language for easily manipulating text, files, and processes. It does many jobs that were formerly done by C programs, shell programs, and Stream Editor (SED) (Wall and Swartz 1990). PDU Filter is used to to filter position, ammunition usage, and enemy sighting data from the PDU data stream. It then reformats the data into the syntaces understood by the FIU and Route Check. The output feeds as a single stream into the BSCA. The two types of data are separated at the other end of the Berkeley Socket.

2.4 The BSCA and the BSSA

The data are transmitted from the workstation running ModSAF to the nodes by way of the BSCA and the BSSA. The BSCA runs on the ModSAF workstation and connects to the BSSA, running on the nodes, over the network and pipes the data stream to the BSSA. The BSSA writes the data to standard output and echoes them back to the BSCA. The BSCA then writes the data to standard output. The writing of the data to standard out at the client end verifies that the data have been successfully transmitted. If the data had somehow been corrupted, that fact could be observed at this time. The BSCA and the BSSA were adapted from examples in *Unix Network Programming* (Stevens 1998).

2.5 P/S/A Tee

P/S/A Tee is a Perl program that separates position data from ammunition usage and enemy-sensing data by testing for particular keywords. It then pipes them to different applications. Position data are handled by Route Check; ammunition usage and enemy sensing data are handled by the FIU.

2.6 Route Check

The Route Check application is the component that deals with the sequential objectives. It extracts all primary and alternate sequential objectives from the DFB for the friendly

units that the user wants to track. When it gets the time from P/S/A Tee, it computes the planned location of each unit and stores the information in the DFB. It then compares the known position of the current unit (also obtained from P/S/A Tee) with its planned location, subject to the allowable error tolerance, called the SOC. The model presented here uses SOCs that are circular.* Information on whether or not the unit is within its expected area is also stored in the DFB.

2.7 The FIU

The FIU is an application written by George Hartwig of IS&TD for creating and updating facts in the DFB. It was originally known as Fact Exchange Protocol (FEP) Driver. In its native form, it uses batch files as input. It was modified to accept input interactively for the CBSAMD.

2.8 DFB

The DFB is the hub about which all data move (except for the P/S/A Tee $\Rightarrow$ Route Check interface). It is an active database that provides both interprocess communications and connectivity to other DFBs (Hartwig 1991). Applications running on a node connect to the DFB on that node. The applications can register **triggers** (Cohen 1989), or active queries, to monitor updates made to the DFB. When data meeting the requirements of the active queries are entered into the database, the application is notified by the DFB. These data may originate from another application or from the DFB of another node, through the use of data distribution rules. Data distribution rules are active queries that tell a DFB to send information to another node when certain conditions are met. They are part of the unit's standing operating procedures (SOPs).

The DFB trigger mechanism allows the various applications to be written with a common data interface instead of requiring them to know how to directly exchange data with each other. This loose coupling permits different applications to be used. Once the IDT application programming interface (API) has been incorporated into a program, it may connect to a DFB, perform updates and queries, register and process triggers, etc. If the programs exchanged data directly, new interfaces would need to be written every time one of the modules was replaced with a different program.

The DFB gets the sequential objectives as part of the operational orders (OPORDs). Each friendly unit has a primary sequence, while alternate sequences provide for contingencies like a bridge being out.

*For details on the construction and implementation of SOCs and sequential objectives, see Hartwig, Brundick, and Kothenbeutel (1996).

2.9 Display Manager

The Display Manager is a graphical user interface. It retrieves the expected and last known locations of all units from the DFB and plots them on a map. It also draws a tolerance area around the expected locations. If a unit strays outside its tolerance area, a data distribution rule instructs the DFB to notify the other nodes of its actual location. The Display Manager can display other information, such as the northing and easting of any selected point on the map. It can also into an identification mode. Then the user "clicks" on any object on the screen to get a summary of information from the DFB. Another mode demonstrates how sequential objectives and SOCs may provide combat ID. The user clicks on the map to place his/her location and then clicks a second time to show his/her line of sight. The program determines if the line intersects any SOCs, indicating that the user is seeing a friendly unit.

2.10 SOC Monitor

The SOC Monitor is an application program that monitors the current unit's location and indicates when the unit is out of its tolerance area. It does so by writing a message to the standard output.

2.11 Other Nodes

The CBSAMD includes five nodes, representing each of the five friendly vehicles in the demonstration: four M1A1 tanks and an Apache helicopter (AH-64D). ModSAF feeds data into five copies of PDU Filter, one for each node. Each PDU Filter feeds into a separate execution of BSCA. Subsequent to BSCA, each component of the diagram in the Executive Summary is duplicated at each node. Only the information pertaining to a particular node is sent to it over the Internet.

2.12 Radio

In accordance with the IDT model, information is transmitted between nodes only when necessary. Necessary information such as contact with hostile forces is transmitted via Single Channel Ground and Airborne Radio System (SINCGARS) radio.

3. Operation of the SA Demonstration

3.1 Overview

The operation of the model is divided into three phases: initialization of the nodes. initialization of the driver, and the execution phase. These phases are depicted in Figure 1.

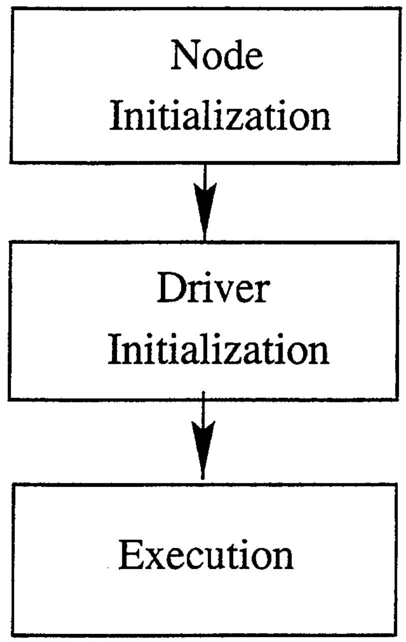

Figure 1. Operation of the Model.

Initialization of the nodes consists of independent actions that are necessary to set up the demonstration. Several application programs are started together. They are Route Check. Display Manager, the FIU. the BSSA, and P/S/A Tee. The BSSA must be started before the BSCA, or the BSCA will fail. Therefore, the nodes must be initialized before the driver can be initialized. Initialization of the driver steps are performed at the beginning of the exercise. ModSAF and the DIS Manager server program are started, and the scenario is loaded into ModSAF. The DIS Client Pipe shell script that runs the DIS Manager client program, the PDU Filter, and the BSCA is poised to start. The script pipes output from the DIS Manager client program into the PDU filter and pipes output from that into the BSCA. This script cannot be started until the ModSAF exercise has begun.

3.2 Execution Phase

In the Execution Phase, the ModSAF exercise is started. Then the DIS Client Pipe shell script is started. The BSCA connects to the BSSA, which was started during the nodes' initializations. The CBSAMD can then proceed without human intervention. The reactions

of the various units to hostile encounters is not predetermined and will vary during separate runs of the CBSAMD. Optionally, the operator can intervene interactively and command a particular unit to withdraw or advance to a particular location.

The ModSAF screen at the beginning of the exercise is shown in Figure 2.

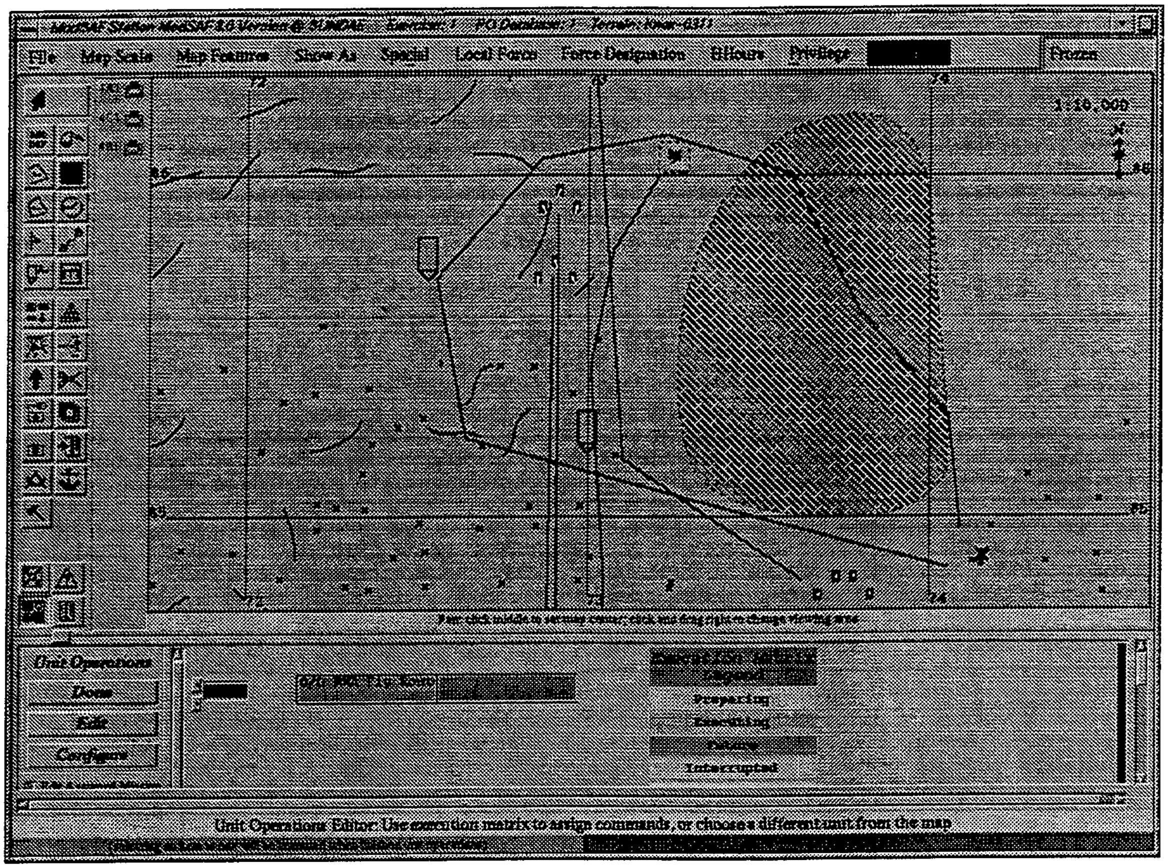

Figure 2. Sample ModSAF Screen.

3.2.1 Discussion

The flexible reactions of the fighting units and the ability to command the units subject the the CBSAMD software to many of the situations to which it may be required to respond in actual combat. The military science built into ModSAF ensures the realism of these situations. Any inappropriate handling of situations can be used for debugging and improving IDT software. The Route Check program receives the time and computes where each unit is expected to be. Route Check stores the computed SOCs in the DFB so that other modules may retrieve the values. It also stores the actual location as provided by P/S/A Tee. along with a flag indicating whether or not the unit is within its SOC. Each time P/S/A Tee sends location data to Route Check, the SOCs are computed and everything is updated in the DFB. Notice that no human intervention is required. Location data are piped directly to

Route Check, which does all the analysis and stores the results in the DFB. Figure 3 shows Display Manager several minutes after the demonstration was started. The circles are the SOCs denoting each unit's expected position.

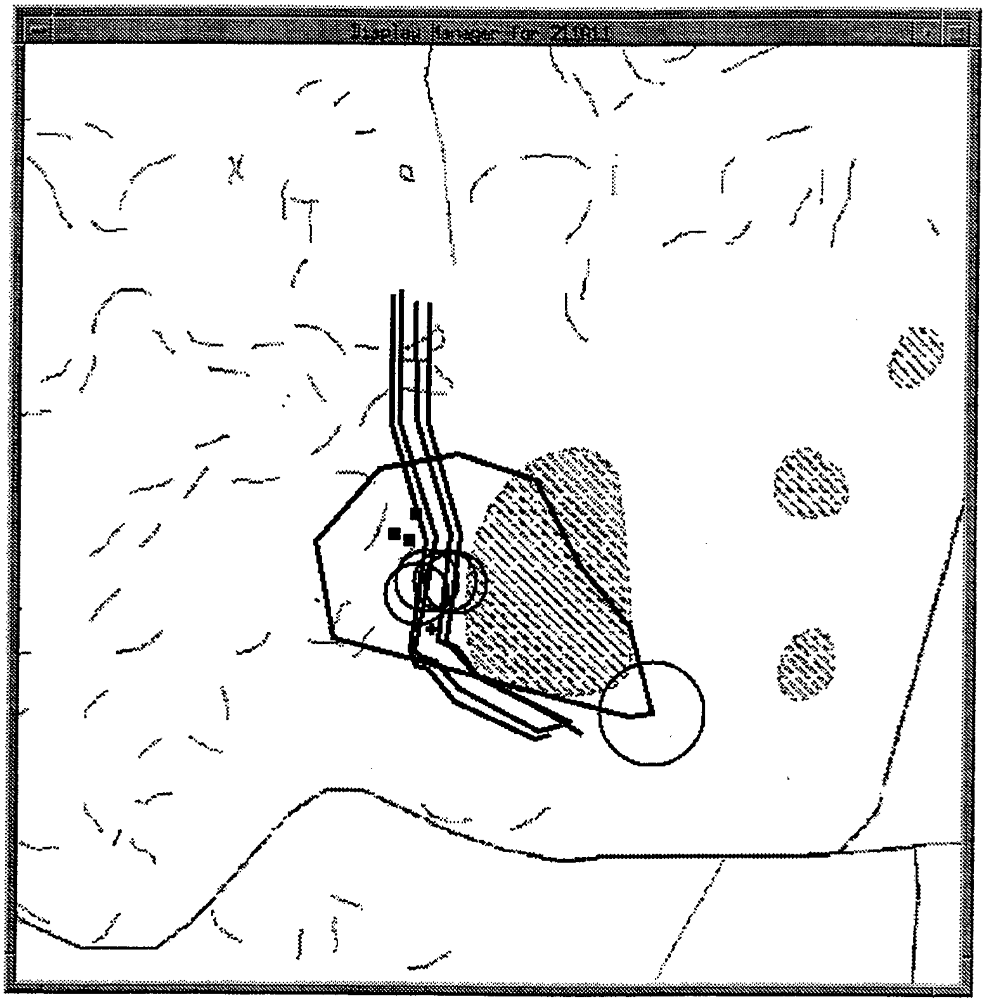

Figure 3. Sample Display Manager Screen.

3.2.2 Course Deviations

Other applications may be notified when the unit is outside of its SOC. The SOC Monitor program registers a trigger for this purpose. When Route Check stores a location with the "out of SOC" flag set, the trigger "fires." The SOC Monitor retrieves the details from the DFB and prints them. A distribution rule causes the unit's actual location to be broadcast at the same time. The small cross below the SOCs in Figure 3 is the home unit's real position. It has left its SOC because of its reaction to the enemy units.

3.2.3 Display Manager

On startup, the Display Manager connects to the DFB and extracts all the sequential objectives. Each active sequence is drawn, using one color for the current unit and another color for all other units. Triggers are registered to notify the Display Manager when the following events occur:

- an actual unit location is stored or updated in the DFB,
- a SOC is stored or updated in the DFB, or
- a unit switches to an alternate sequence.

4. Useful Enhancements

The CBSAMD can be improved by adding another ModSAF driver to control the enemy units. Two workstations would be running the same exercise, each controlling opposite sides of the battle. This step would add realism in that neither side could predict the other's movements.

The Defense Modeling and Simulation Office (DMSO) promulgates modeling and simulation policy among Department of Defense (DOD) components. They recently established a common High-level Simulation Architecture (HLA) to which models and simulations must conform. It is recommended that the CBSAMD be made HLA compliant in the near future (Defense Modeling and Simulation Office 1998).

Another useful enhancement would be to distribute estimates of enemy degraded performance. On the battlefield, a human observer could observe, for example, that the engine of an enemy tank was smoking and deduce a mobility kill from that. ModSAF reports such information through PDUs.

5. Conclusions

The structure and operation of the CBSAMD, a situation awareness démonstration that is driven by a state-of-the-art battlefield simulation, ModSAF, has been described. Offering virtually "hands-off" operation, the CBSAMD shows how a major improvement in supplying vital information to the commander is possible without a major increase in human effort. Further, the CBSAMD demonstrates significant improvements in keeping this awareness current with a minimum use of precious bandwidth.

Finally, a number of enhancements to the CBSAMD have been offered, which will significantly improve its realism and usefulness.

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6. References

Chamberlain, S. C. "The Information Distribution System: IDS—An Overview." BRL-TR-3114, U.S. Army Ballistic Research Laboratory, Aberdeen Proving Ground, MD, 1990.

Cohen, D. "Compiling Complex Database Triggers." *Proceedings of the ACM SIGMOD*. 1989.

Defense Modeling and Simulation Office, Internet Resource URL http://www.dmso.mil, 1998.

Distributed Interactive Simulation Data Dictionary - PDU Data, Internet Resource URL http://siso.sc.ist.ucf.edu/dis/dis-dd/pdu, 1998.

Hartwig, G. W., Jr. "The Information Distribution System: The Factbase." Technical Report BRL-TR-3247, U.S. Army Ballistic Research Laboratory, Aberdeen Proving Ground, MD, 1991.

Hartwig, G. W., Jr., F. S. Brundick, and CPT(P) S. D. Kothenbeutel. "Tactically Significant Route Planning." Technical Report ARL-TR-1139, U.S. Army Research Laboratory, Aberdeen Proving Ground, MD, 1996.

ModSAF: Modular Semi-Automated Forces, Kit A, Defense Modeling, Simulation, and Tactical Technology Information Analysis Center, Service Center, Orlando, FL. 1996.

Smith, K. G. "Distributed Interactive Simulation (DIS) Network Manager." Technical Report ARL-TR-780, U.S. Army Research Laboratory, Aberdeen Proving Ground, MD. 1994.

Stevens, W. R. "Chapter 5. TCP Client-Server Example." *UNIX Network Programming, Volume 1, Second Edition: Networking APIs, Sockets, and XTI*, pp. 112-115, Prentice Hall, 1998.

Wall, L. and R. L. Schwartz. *Programming Perl*, O'Reilly and Associates, 1990.

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List of Abbreviations

API	Application Programming Interface
ARL	Army Research Laboratory
BSCA	Berkeley Socket Client Application
BSSA	Berkeley Socket Server Application
CBSAMD	Computation Based Situation Awareness Methodlogy Demonstration
DIS	Distributed Interactive Simulation
DFB	Distributed Factbase
DMSO	Defense Modeling and Simulation Office
DMSTTIAC	Defense Modeling, Simulation, and Tactical Technology Information Analysis Center
DOD	Department of Defense
FEP	Fact Exchange Protocol
FIU	Factbase Input Utility
HLA	High-level Simulation Architecture
ID	Identification
IDT	Information Distribution Technology
IS&TD	Information Science and Technology Directorate
JSTARS	Joint Surveillance Target Attack Radar System
LAN	Local-area Network
ModSAF	Modular Semi-automated Forces
OPORD	Operational Orders
PDU	Protocol Data Unit
PM-DIS	Program Manager - Distributed Interactive Simulation
P/S/A	Position/Sensing/Ammunition
SA	Situation Awareness
SINCGARS	Single Channel Ground and Airborne Radio System
SOC	Shape of Certainty
SOP	Standing Operating Procedure

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	August 1999	Final, Jul 97 - Aug 98

4. TITLE AND SUBTITLE
A Demonstration of a Computationally Intensive Situation Awareness Methodology

5. FUNDING NUMBERS
P622783.Y10
9TED10
BTAO

6. AUTHOR(S)
Howell Caton and Frederick S. Brundick

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Research Laboratory
ATTN: AMSRL-IS-TP
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8. PERFORMING ORGANIZATION REPORT NUMBER
ARL-TR-2025

9. SPONSORING/MONITORING AGENCY NAMES(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

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14. SUBJECT TERMS
situation awareness, ModSAF, command and control, communications, information distribution technology

15. NUMBER OF PAGES
21

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

NSN 7540-01-280-5500

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